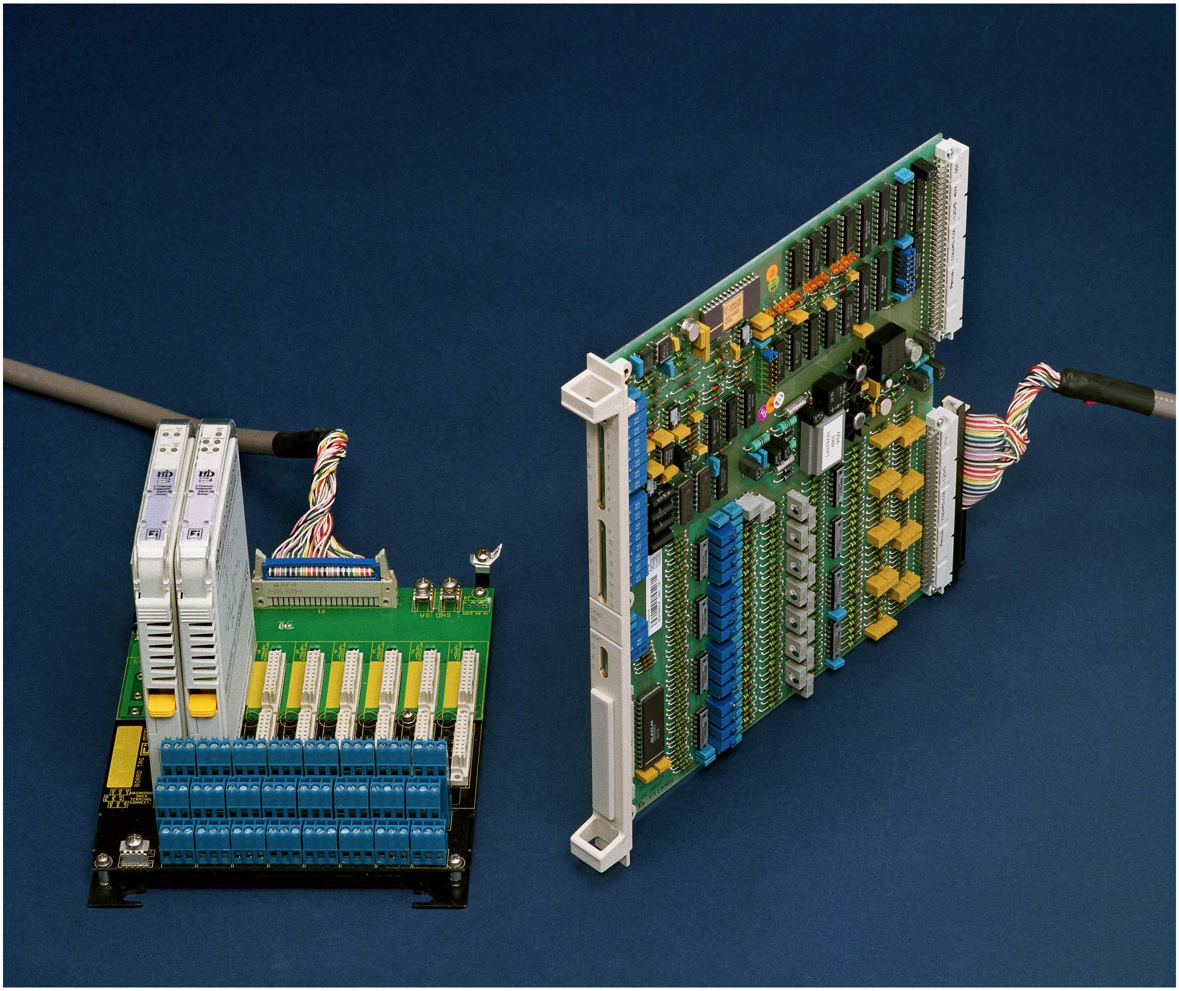
Intrinsic Safety Support
S100 I/O with Series 2000
Version 1.0

User’s Guide



Advant® OCS

Instrinsic Safety Support

S100 I/O with Series 2000
Version 1.0

User’s Guide

3BSE 018 949R101

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TABLE OF CONTENTS

Chapter 1 - Introduction

1.1 About This Book 1
    1.1.1 How to Use this Book 2
1.2 Product Overview 5
    1.2.1 S100 I/O 7
        1.2.1.1 Supported S100 I/O Boards 7
    1.2.2 Termination Board 8
    1.2.3 Interface Adapter Card 8
    1.2.4 Intrinsic Safety Isolator Modules 10
    1.2.5 Supported Signal Types 11
    1.2.6 Cabinets 12
    1.2.7 Ordering and Deliveries 14
1.3 Release History 14
1.4 Equipment Requirements 15
1.5 Related Documentation 16
1.6 Conventions 16
1.7 Terminology 17

Chapter 2 - Installation

2.1 Site Planning Environment 19
    2.1.1 Grounding 19
    2.1.2 Power Supply 19

CONTENTS (continued)

2.2 Installation Procedure 19
  2.2.1 S100 I/O Board 19
  2.2.2 Intrinsic Safety System 20
  2.2.3 Cable Connections 20
    2.2.3.1 DSAI 130 21
    2.2.3.2 DSAI 133 22
    2.2.3.3 DSAO 120 23
    2.2.3.4 DSAX 110 24
    2.2.3.5 DSDI 110A, DSDI 115 and DSDP 110 25
    2.2.3.6 DSDO 110 and DSDO 115 26
    2.2.3.7 DSDP 150 27
    2.2.3.8 DSDX 180 28
  2.2.4 Supported I/O Functions 29

Chapter 3 - Configuration

3.1 Considerations 31
  3.1.1 Termination Board 31
  3.1.2 Intrinsic Safety Isolator Module 31
  3.1.3 AI, AO and AX Boards 31
  3.1.4 DI, DO, DP and DX Boards 33
3.2 Capacity and Performance 34
  3.2.1 Technical Data 34
  3.2.2 Analog Input/Output 34
  3.2.3 Digital Input/Output 34
  3.2.4 Pulse Counting/Frequency Measurement 34
3.3 Application Procedures 34
  3.3.1 Linearization TC Signal 35
    3.3.1.1 Linearization in Advant Controller with Master Software 36
  3.3.2 Scaling of RTD and TC Signals 38

CONTENTS (continued)

Chapter 4 - Operation

Chapter 5 - Maintenance

5.1 Hardware Indicators 41
5.2 Fault Finding and User Repair 41
5.2.1 Interface Adapter Card 41
5.2.2 Analog Input Signals, Current, RTD and TC 42
5.2.3 Analog Output Signals 53
5.2.4 Digital Input Signals and Pulse Counting Signals 58
5.2.5 Digital Output Signals 64

Chapter 1 Introduction

1.1 About This Book

Intrinsic Safety Galvanic Isolators is the most cost affective means of implementing Intrinsic Safety into your Hazardous Area applications. The basic principle is to **replace** the connection units of the S100 I/O-system with termination boards housing the I.S. Isolator modules.

The Advant Controller 400 Series and the Intrinsic Safety System are always delivered in separate cabinets and can be considered as two systems working together. Connections between the cabinets are done with standard cables.

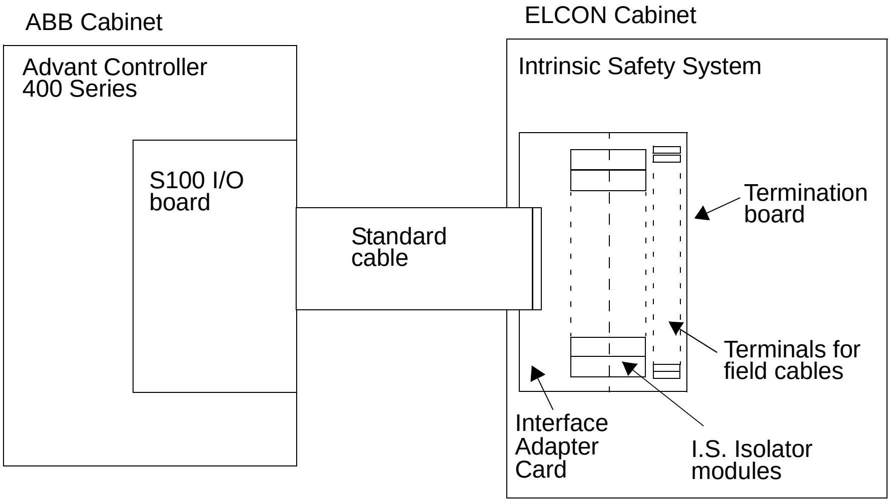

Figure 1-1. S100 I/O together with ELCON Instruments Intrinsic Safety System

This document describes how to use S100 I/O together with Intrinsic Safety System Series 2000 from ELCON Instruments.

For description of S100 I/O or Intrinsic Safety System Series 2000 from ELCON Instruments see document according to the document list in Section 1.5, Related Documentation.

Use of Warning, Caution, Information, and Tip Symbols

This publication includes **Warning**, **Caution**, and **Information** symbols where appropriate to draw the readers attention to safety-related or other important information. It also includes a symbol for **Tips** to provide useful hints to the reader. The symbols should be interpreted as follows:

⚠ Warning indicates the presence of a hazard which could result in *personal injury*.

❗ Caution indicates the presence of a hazard which could result in *equipment or property damage*.

ℹ Information alerts the reader to pertinent facts and conditions.

💡 Tip indicates advice on, for example, how to design your project or how to use a certain function.

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, it is important to comply fully with all **Warning** and **Caution** notices.

1.1.1 How to Use this Book

Figure 1-2 shows the basic structure of the Advant System's various documentation. Each document, whether it is describing and referencing hardware or software, is built around this one structure making it easy to locate related information in any of the documents.

Since this one structure is not completely applicable to both hardware and software, certain sections contain only very brief statements in some documents.

This book is organized into chapters and sections as shown in Figure 1-2.

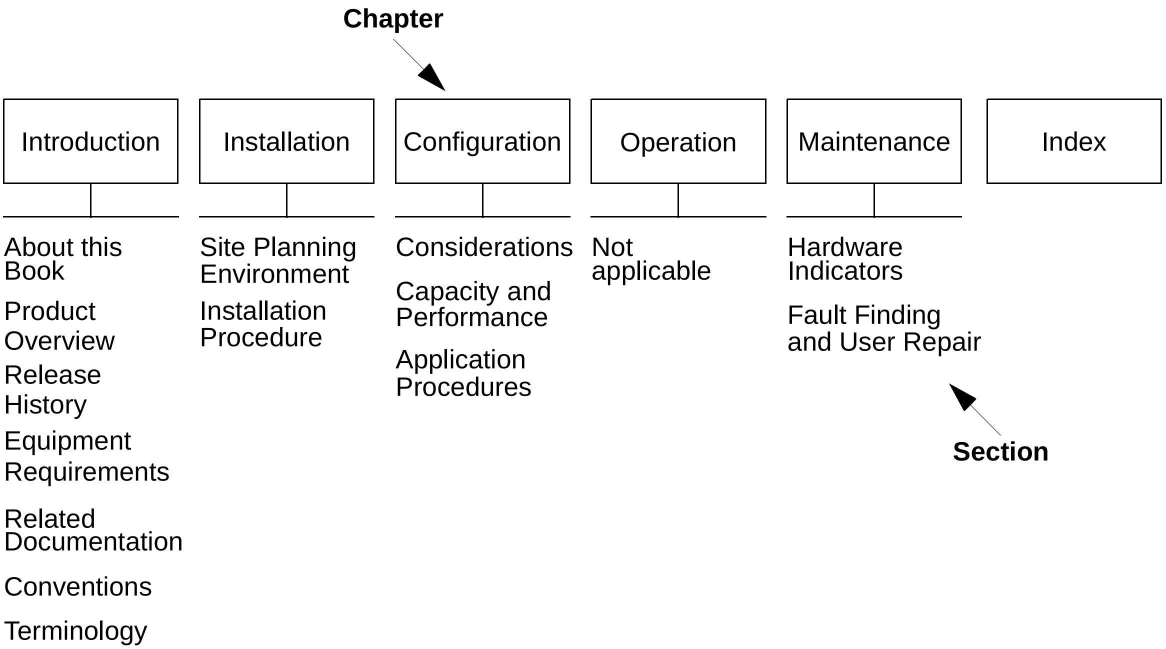

Figure 1-2. Organization of Manual

Chapter 1, Introduction

provides introductory and background information. This information includes:

- Guidelines how you can find information in the manual.
- The relation to other documents related to the operation of the S100 I/O and ELCON Intrinsic Safety system.
- A product and functional overview that give you an idea of what the S100 I/O and ELCON Intrinsic Safety system can do and how it works.

Chapter 2, Installation

guides in different installation activities:

- Section 2.1, Site Planning Environment, guidelines for planning installation of the product.
- Section 2.2, Installation Procedure gives you information how to set up the equipment. Includes also safety regulations, handling and unpacking instructions, inspection and assembly procedures, cable routing and connections, setup procedures and so on. Common instructions as well as instructions directed to specific subsystem are given. Activities prior to power up are described.

Chapter 3, Configuration

will give you the information needed to obtain the desired function. The main information is structured as follow:

- Section 3.1, Considerations and guidelines are given.
- Section 3.2, Capacity and Performance.

Chapter 4, Operation

is not applicable in this manual.

Chapter 5, Maintenance

focus is on fault finding supported by built in diagnostics and use of system status displays in operator station and LEDs on I/O hardware units.

INDEX

It will offer you an easy way of finding information.

1.2 Product Overview

The S100 I/O and the Intrinsic Safety System Series 2000 are always delivered in separate cabinets. Connections between the cabinets are done with standard cables.

Figure 1-3 shows the conceptual structure for S100 I/O together with ELCON Instruments Intrinsic Safety System. An Intrinsic Safety System consists of a termination board, I.S. Isolator modules and an interface adapter card.

To the Interface Adapter Card can a HART mux be connector for HART communication, see Figure 1-4.

The Intrinsic Safety system is transparent both for system and application software in S100 I/O.

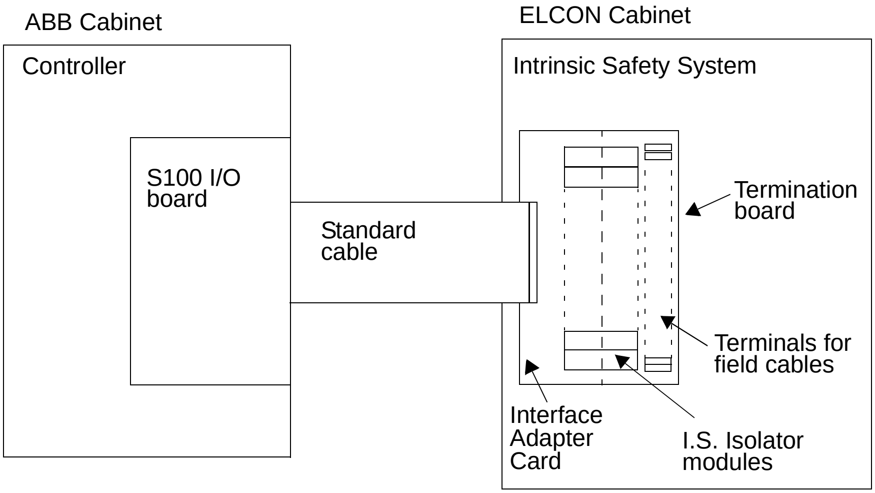

Figure 1-3. Conceptual Structure for S100 I/O together with ELCON Instruments Intrinsic Safety System

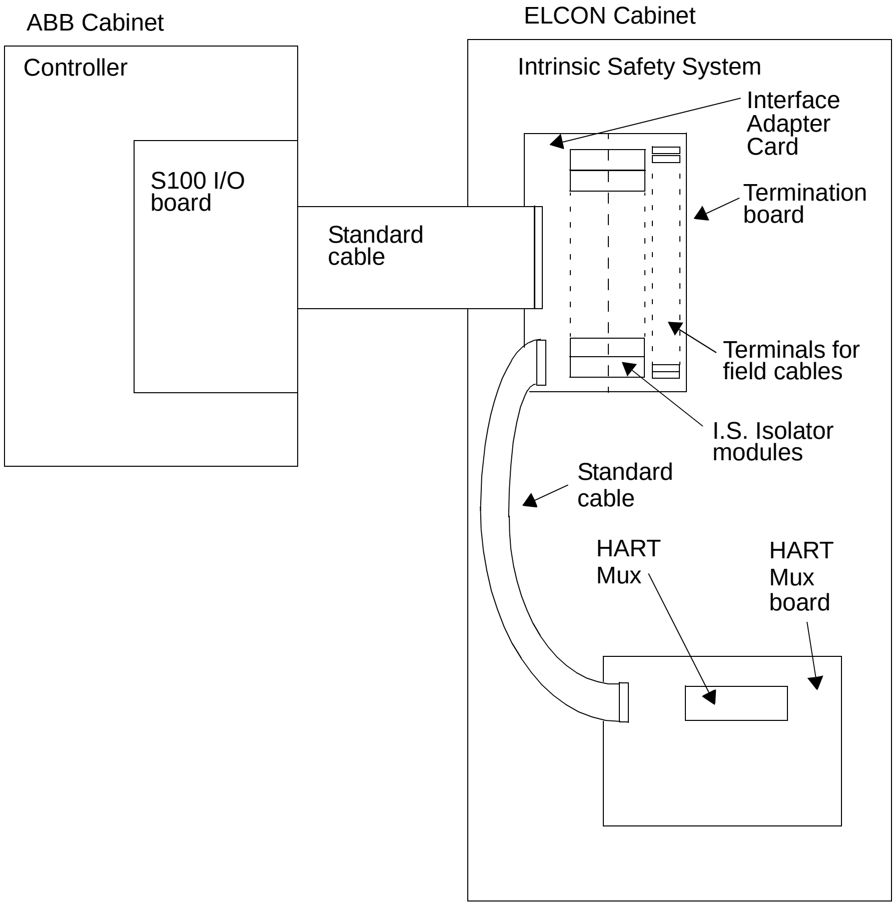

Figure 1-4. Conceptual Structure for S100 I/O together with ELCON Instruments Intrinsic Safety System with HART Communication

1.2.1 S100 I/O

The S100 I/O consists of several I/O boards and cables covering a wide variety of applications. For this application only a selection of the S100 I/O boards and cables is used.

The cables that connect the cabinets are prefabricated round screened ribbon cables with connectors and with a length up to 15 m.

The S100 I/O boards and the cables are ordered as a set including I/O board and cable.

1.2.1.1 Supported S100 I/O Boards

Interface Adapter Card available for following S100 I/O boards.

Table 1-1. Supported S100 I/O Boards

Board	Description
DSAI 130	16 AI channels, resolution 12 bit
DSAI 133	32 AI channels, resolution 12 bit, redundancy possible
DSAX 110	8 AI + 8 AO channels, resolution 12 bit, redundancy possible
DSAO 120	8 AO channels, resolution
DSDI 110A	32 DI channels
DSDI 115	32 DI channels
DSDO 110	32 DO channels
DSDO 115	32 DO channels
DSDX 180	32 DI/DO channels, resolution, redundancy possible
DSDP 110	28 pulse counting channels max 40 Hz
DSDP 150	12 pulse counting channels max 10 kHz

1.2.2 Termination Board

All Series 2000 I.S. Galvanically Isolated Barriers have to be plugged into an ELCON Series 2108 or 2116 Termination Board. (8 positions or 16 positions).

The Termination Board is supplied as standard with a rugged metal chassis that can be grounded by means of a dedicated GND Stud and guarantees an IP20 degree of protection.

All boards provide blue Terminals on the field side for field cable conductors up to 12 AWG (2.5 mm^2) and a place for the Interface Adapter Cards.

Following is a description of the Termination Boards Series 2000 suitable for the Interface Adapter Card.

.

Table 1-2. Termination Boards Series 2000

Base Model	**Hazardous Area Options**	**Safe Area Options**	**Description**
2108		See Table 1-5	8 position terminal board
2116		See Table 1-5	16 position terminal board
	/HAT	See Table 1-5	Hazardous-area screw-clamp terminals
	/HAKE (1)	See Table 1-5	Hazardous-area loop-disconnect terminals

(1) Can not be used for 4 channel modules and RTD and TC modules.

For more detailed information, see *ELCON Instruments documentation*.

1.2.3 Interface Adapter Card

The Interface Adapter Card (I.A.C.) is an adaptation of the termination board to S100 I/O. It contains an interconnection between S100 I/O channels and the safe-side and the I.S. modules. The I.A.C. is delivered by ELCON Instruments.

A redundant 24V connection for the internal supply bus is included on every I.A.C.

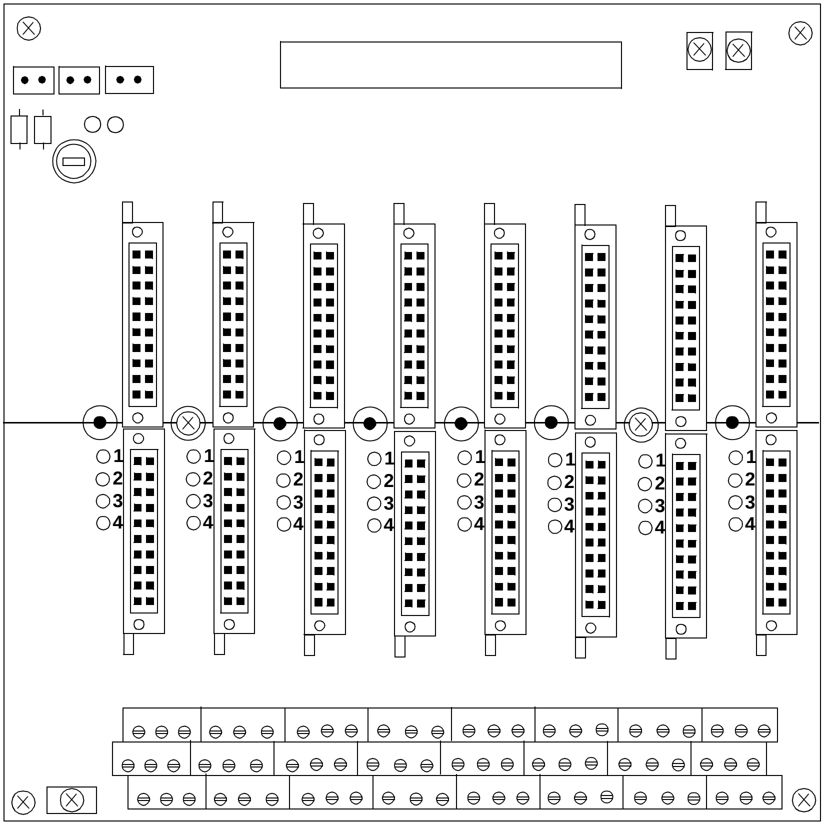

Figure 1-5. Termination Board with Interface Adapter Card

1.2.4 Intrinsic Safety Isolator Modules

The Intrinsic Safety isolator modules (I.S. Isolator modules) are an ELCON Instruments standard product. There are modules for digital input, digital output, analog input, analog output, thermocouple input, RTD input and pulse counting up to 2 kHz.

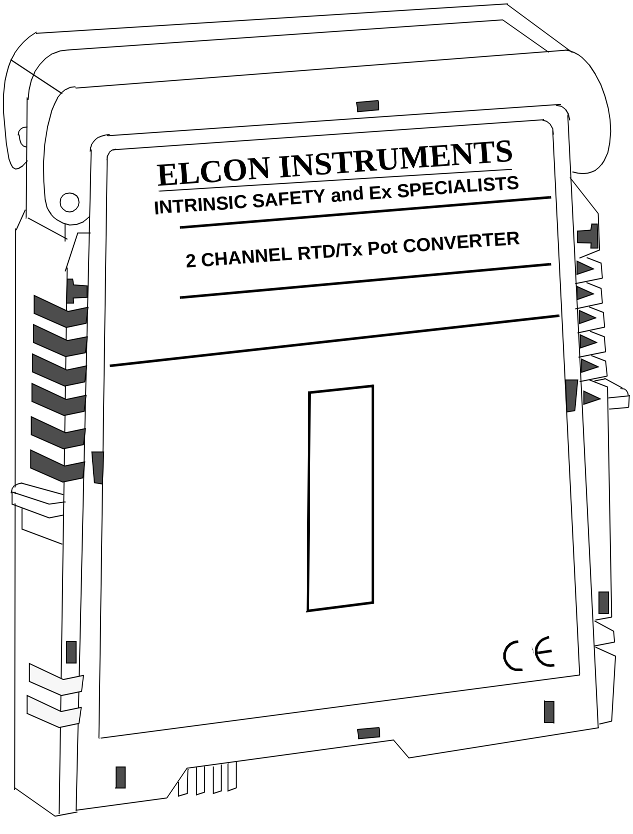
ELCON INSTRUMENTS
INTRINSIC SAFETY and Ex SPECIALISTS
2 CHANNEL RTD/Tx Pot CONVERTER
CE

Figure 1-6. Intrinsic Safety Isolator

For more detailed information see *ELCON Instruments documentation*.

1.2.5 Supported Signal Types

The signal type and signal range is determined by selection of the I.S. Isolator module.

Table 1-3. Model Selection

Type	Model	No. of Channels	Hazardous Area Signal	Safe Area Signal
AI	HiD 2026	2	4-20 mA (15,5V) floating supply to Smart or non-Smart two wire Transmitters	4-20 mA (or 1-5V) output isolated input, Smart compatible
AI	HiD 2030	2	4-20 mA (15,5V) floating supply to Smart or non-Smart two or three wire Transmitters	4-20 mA (or 1-5 V) output isolated from input and power supply, Smart compatible, Line Fault Detection
AO	HiD 2032	2	4-20 mA to I/P converters, electrovalve actuators and displays	Bus powered, 4-20 mA signal from DCS, PLC or other control devices
AO	HiD 2034	2	4-20 mA to I/P converters, electrovalve actuators and displays	Loop powered, 4-20 mA signal from DCS, PLC or other control devices. Can only be used for load resistance ≤ 150 ohm.
AO	HiD 2038	2	4-20 mA and Smart signal to I/P converters, electrovalve actuators and displays	Bus powered, 4-20 mA signal from DCS, PLC or other control devices
Low level IN	HiD 2062	2	Thermocouple or mV	4-20 mA (or 1-5 V) output isolated from input
Low level IN	HiD 2072	2	RTD or Potentiometer	4-20 mA (or 1-5 V) output isolated from input
DI	HiD 2824	4	Dry Contact or Proximity Switch	DPST relay per channel, Line Fault Detection

Table 1-3. Model Selection (Continued)

Type	Model	No. of Channels	Hazardous Area Signal	Safe Area Signal
DI	HiD 2844	4	Dry Contact or Proximity Switch	1 open-collector outputs per channel, Line Fault Detection
DO	HiD 2872	2	40 mA at 12 V to drive solenoid valve, audible or visual alarm (LED)	Bus powered and/or loop powered, controlled by DCS or control device
DO	HiD 2874	2	40 mA at 12 V to drive solenoid valve, audible or visual alarm (LED)	Bus powered controlled by DCS or control device, Line Fault Detection

For more detailed information see *ELCON Instruments documentation.*

1.2.6 Cabinets

The S100 I/O is installed in standard cabinets, see *User's Guides for the different products in S100 I/O*. The I/O boards for Intrinsic Safety System will in Advant Controller 450, be placed in subrack which are located in the right part of the cabinet configuration.

The Intrinsic Safety system can be installed in a ELCON Instruments cabinet or in an ABB RH5xx cabinet. Installation in ELCON Instruments cabinet see *ELCON Instruments documentation.*

Typical installation in a cabinet see Figure 1-7. Cabinet can be both single and double sided.

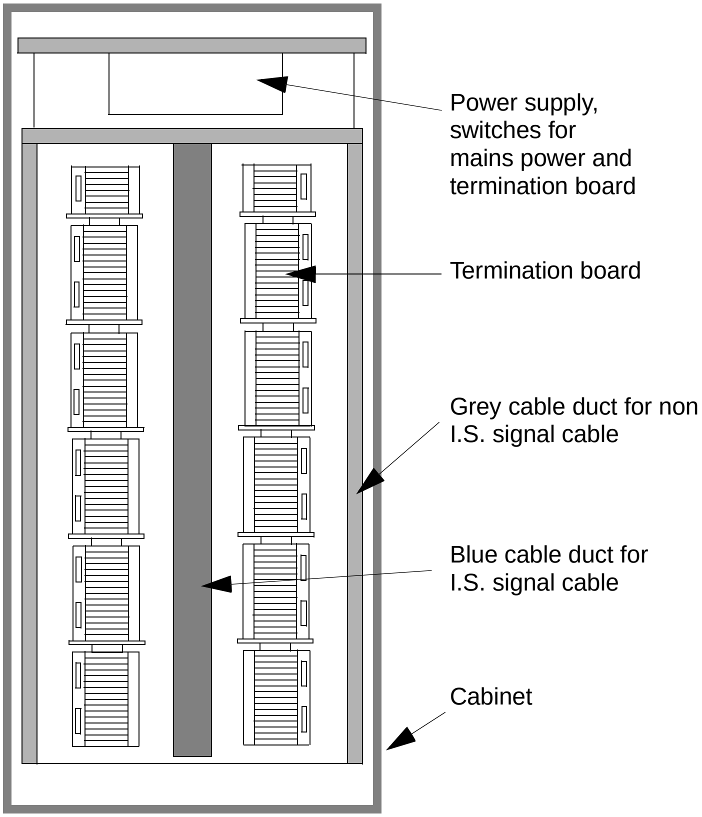
Power supply, switches for mains power and termination board
Termination board
Grey cable duct for non I.S. signal cable
Blue cable duct for I.S. signal cable
Cabinet

Figure 1-7. Intrinsic Safety System in Cabinet

1.2.7 Ordering and Deliveries

S100 I/O shall be ordered from ABB according to the *Advant OCS Product Guide*.

Intrinsic Safety system and HART communication shall be ordered from ELCON Instruments Factory in Italy according to ELCON Instruments conditions of purchase.

ABB delivers the Advant Controller 400 Series in ABB standard cabinets.

ELCON Instruments delivers the Intrinsic Safety system in ELCON Instruments standard cabinet or in an ABB RH5xx cabinet.

1.3 Release History

Table 1-4 shows the development of Intrinsic Safety System in Advant Controller 400 Series, for S100 I/O.

Table 1-4. Release History

Version	Description
1.0	This is the initial Intrinsic Safety Isolator Series 2000 for S100 I/O.

1.4 Equipment Requirements

S100 I/O board, cables, termination boards with integrated Interface Adapter Card and Intrinsic Safety Isolators

Table 1-5. S100 I/O Boards

S100 I/O Boards	**ABB Cable**	**S2000 Termination Board Interface Adapter Card**	**Note**	**Module Capability**	**Module Type (all two channel unless stated)**
DSAI 130	DSTK 160L	2108/HAT/ABB-AI-02	1 I/O cards	8	HiD2026, 2030, 2062, 2072
DSAI 133	DSTK 152SL	2116/HAT/ABB-AI-01	1 or 1+1 I/O cards	16	HiD2026, 2030, 2062, 2072
DSAO 120	DSTK 153SL	2108/HAT/ABB-AO-02	2 I/O cards	8	HiD2032, 2034, 2038
DSAX 110	DSTK 153SL	2108/HAT/ABB-AIO-01	1 or 1+1 I/O cards	8	HiD2026, 2030, 2062, 2072 HiD2032, 2034, 2038
DSDI 110 DSDI 115 DSDP 110	DSTK 160L	2108/HAT/ABB-DI-01	1 I/O card	8	HiD2824, 2844, (4ch)
DSDO 110 DSDO 115	DSTK 160L	2116/HAT/ABB-DO-01	1 I/O card	16	HiD2872, 2874
DSDX 180 (1)	DSTK 152SL	2116/HAT/ABB-DX-01	1 or 1+1 I/O cards, 2ch mods	16	HiD2822, 2842, 2872, 2874
DSDP 150	DSTK 160L	2108/HAT/ABB-DP-01	1 card, 6 pos. used	8	HiD2842

(1) Only supported in MOD software.

1.5 Related Documentation

This manual only describes the combination of S100 I/O and Intrinsic Safety System series 2000, and refers to other documentation in questions concerning S100 I/O and Intrinsic Safety System Series 2000.

Table 1-6 lists all documentation related to Intrinsic Safety Support S100 I/O.

Table 1-6. Related Documentation

Category	Title	Description
Hardware	Advant OCS Product Guide with Master Software	General description and ordering information for ABB Master.
	Advant Controller 410 User´s Guide	Description for Advant Controller 410.
	Advant Controller 450 User´s Guide	Description for Advant Controller 450.
	S100 I/O Hardware Reference Manual	Describes the hardware involved in the process interface S100 I/O.
	ELCON Instruments General Catalog	General description of ELCON Instruments Intrinsic Safety System
	ELCON Instruments HiD Series 2000 Intrinsic Safety Isolators	Description of Intrinsic Safety Isolator modules and Termination Boards.

1.6 Conventions

The following conventions are used throughout this book for the presentation of material:

- In a syntax rule statement or example, a word in **boldface** represents a reserved, keyword or string.
- References to other documents are in *italic*.

1.7 Terminology

The following is a list of terms associated with safety support that you should be familiar with.

Term	Description
S100 I/O	S100 I/O is the group of input and output boards located in the I/O subrack (centralized I/O).
AC 400	Advant Controller 400 Series.
I.S. 2000	ELCON Instruments Intrinsic Safety System Series 2000
RTD	Resistance Thermometer Detector
TC	Thermocoupler

Chapter 2 Installation

2.1 Site Planning Environment

The cables between the Advant Controller 400 Series and the Intrinsic Safety System can have a length of maximum 15 m (49 ft.), which limits the distance between the cabinets to about 9 m (30 ft.).

For further information, please refer to the documentation according to the document list in Section 1.5, Related Documentation.

2.1.1 Grounding

The cabinets must be grounded to the same grounding system.

For further information, please refer to the documentation according to the document list in Section 1.5, Related Documentation.

2.1.2 Power Supply

The 24 V power supply to the I.S. isolator modules and the S100 I/O boards must be connected to the same reference ground.

2.2 Installation Procedure

2.2.1 S100 I/O Board

For installation of S100 I/O board in Advant Controller 410 or 450, see *Advant Controller 410 User´s Guide or Advant Controller 450 User´s Guide*.

2.2.2 Intrinsic Safety System

- Complete package solution using either standard ABB RH5xx Cabinets, Elcon Standard or Custom Cabinets.
- High density layout, housing up to 1400 channels in a dual sided single cabinet providing substantial cost/space saving with complete I.S. and non I.S. cable segregation.
- Low power consumption and dissipation limiting UPS power and cabinet ventilation requirements while maintaining cool, reliable operation of electronic circuits.
- Fully field configurable I/O interfaces giving extra flexibility for those last minute changes that can occur during the start-up phase.
- Redundant configuration option is readily achieved using the same Termination boards.

For installation of Intrinsic Safety System, see *ELCON Instruments documentation*.

2.2.3 Cable Connections

A wide range of Series HiD2000 Isolating I/O Modules are available to interface Intrinsically Safe Transmitters, I/P's Valve Positioners, Solenoid Valves, Proximity Sensors, Dry (Voltage Free) Contacts, and low level signals such as TC's and RTD's.

Elcon's rugged termination boards connect via the Interface Adapter Card directly to the S100 I/O cards via the standard prefabricated ABB cables, up to 15 m (39') away.

Elcon termination boards and Interface Adapter Card are interchangeable with standard (non I.S.) ABB I/O interfaces, plugging directly into S100 I/O System using standard ABB cables with no extra wiring required.

Robust fixed or loop disconnect terminal blocks permit direct wiring of all field cables, including shields.

2.2.3.1 DSAI 130

The Interface Adapter Card has one connection for cable to DSAI 130, see Figure 2-1.

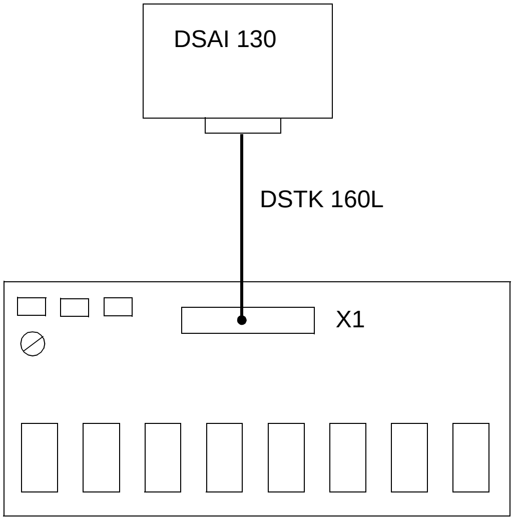

Figure 2-1. Interface Adapter Card connection of Cable to DSAI 130

2.2.3.2 DSAI 133

The Interface Adapter Card has four connectors for cables to two DSAI 133 (redundance) and two connectors for cables to HART multiplexer board, see Figure 2-2.

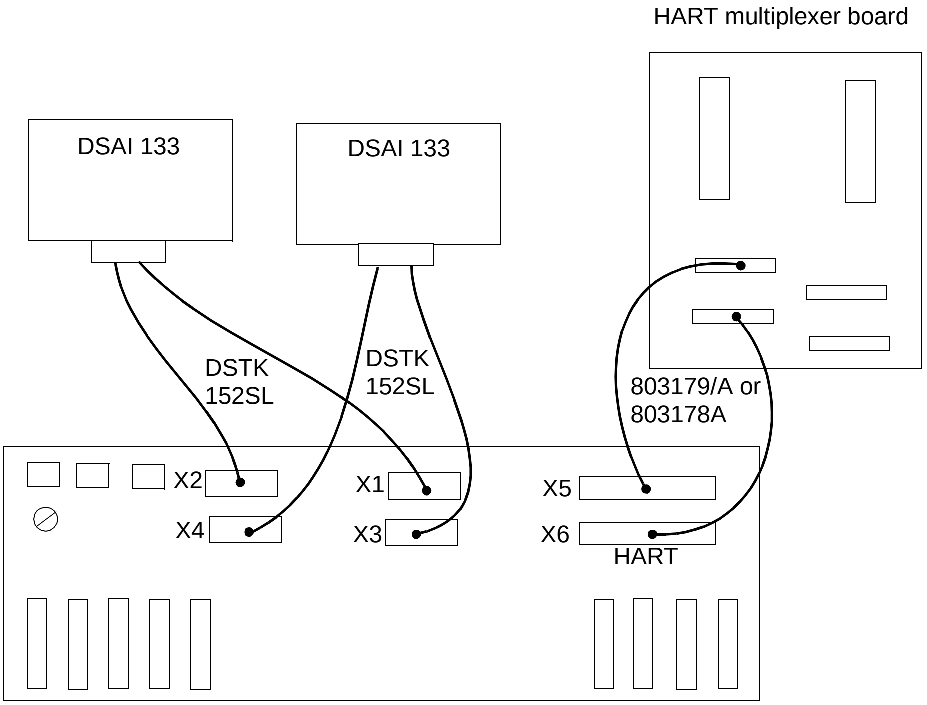

Figure 2-2. Connection of redundant DSAI 133 to Interface Adapter Card and Connection to HART Multiplexer Board

Connect as follows:

Connectors X1 and X3 to position 1 - 8 and connectors X2 and X4 to position 9 - 16.

Connector X5 to position 1 - 8 and connector X6 to position 9 - 16.

2.2.3.3 DSAO 120

The Interface Adapter Card has connectors for cables from two DSAO 120 and one cable to HART multiplexer board, see Figure 2-3.

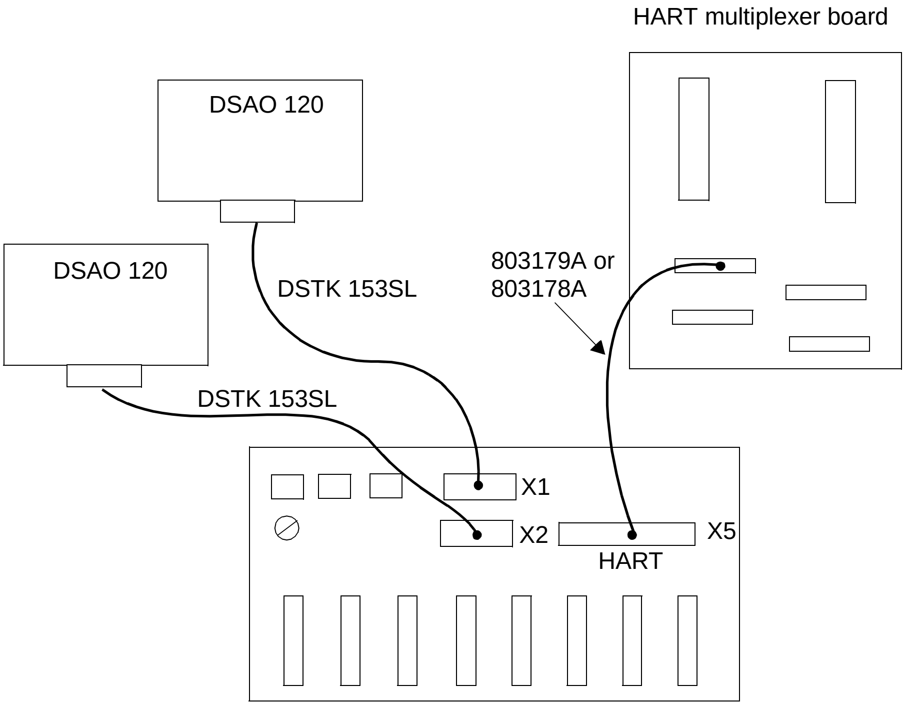

Figure 2-3. Connections of two DSAO 120 to Interface Adapter Card and to HART Multiplexer Board

Connect as follows:

Connector X1 to position 1 - 4 and connector X2 to position 5 - 8.

Connector X5 HART to position 1 - 8.

2.2.3.4 DSAX 110

The Interface Adapter Card has two connectors for cables to/from two DSAX 110 (redundance) and one connector for a cable to HART multiplexer board, see Figure 2-4.

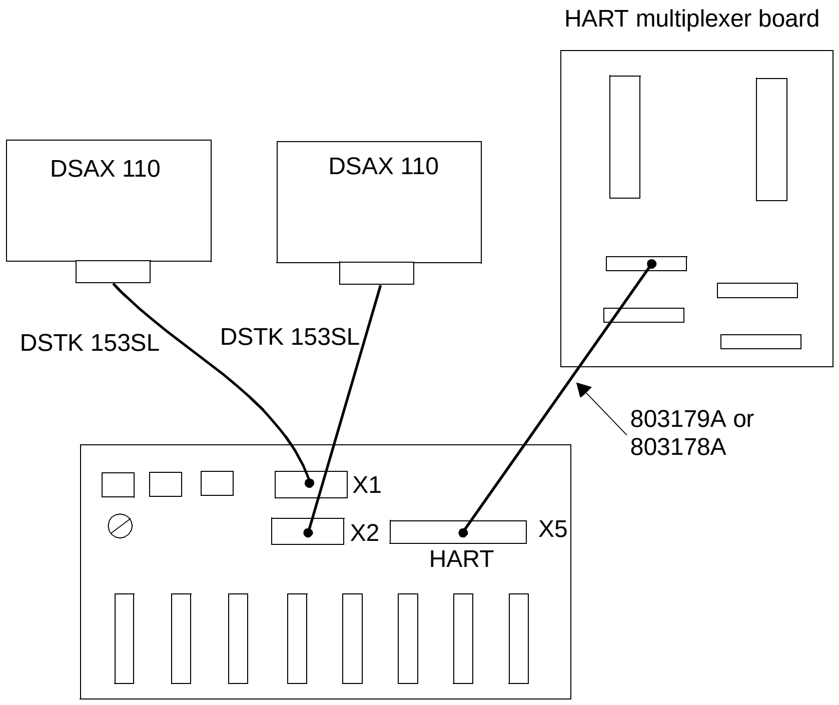

Figure 2-4. Connection of redundant DSAX 110 to Interface Adapter Card and Connection to HART Multiplexer Board

Connect as follows:

Connectors X1 and X2 to position 1 - 8.

Connector X5 to position 1 - 8.

2.2.3.5 DSDI 110A, DSDI 115 and DSDP 110

The Interface Adapter Card has one connection for cable to DSDI 110A, DSDI 115 and DSDP 110, see Figure 2-5.

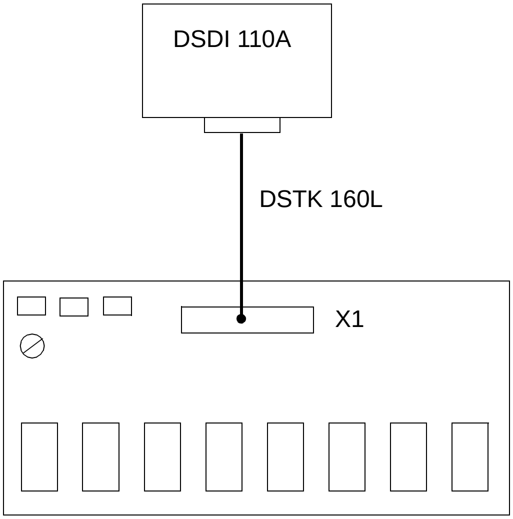

Figure 2-5. Connection of DSDI 110A, DSDI 115 or DSDP 110 to Interface Adapter Card

2.2.3.6 DSDO 110 and DSDO 115

The Interface Adapter Card has one connection for a cable to DSDO 110 and DSDO 115**,** see Figure 2-6.

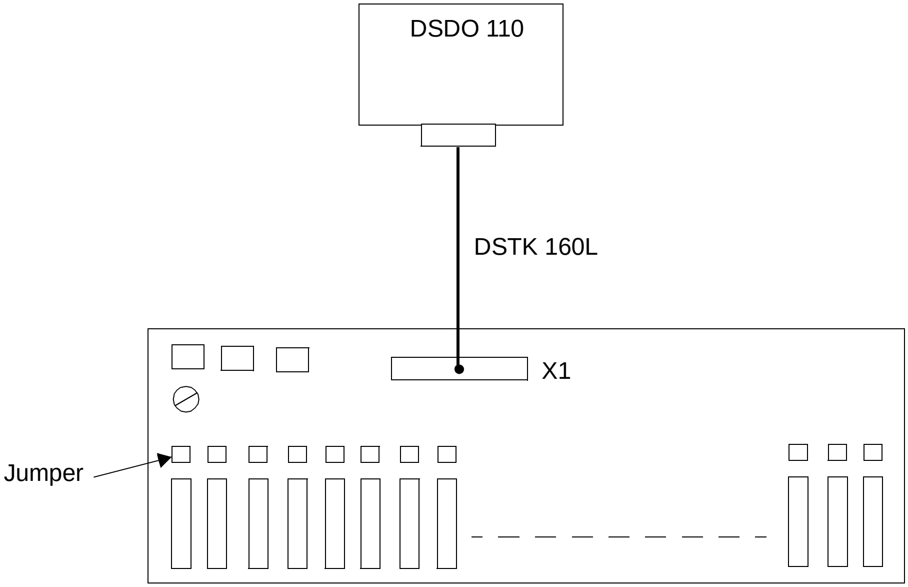

Figure 2-6. Connection of DSDO 110 or DSDO 115 to Interface Adapter Card

There is one jumper per channel to select between bus or loop powered function.

Jumper in	Position 1 - 2:	HiD2872	Loop power [1]
	Position 2 - 3:	HiD2872, 2874	Bus power [2]

---

[1] HiD2872 configured for Loop power.

[2] HiD2872 configured for Bus power.

2.2.3.7 DSDP 150

The Interface Adapter Card has one connection for cable to DSDP 150, see Figure 2-7.

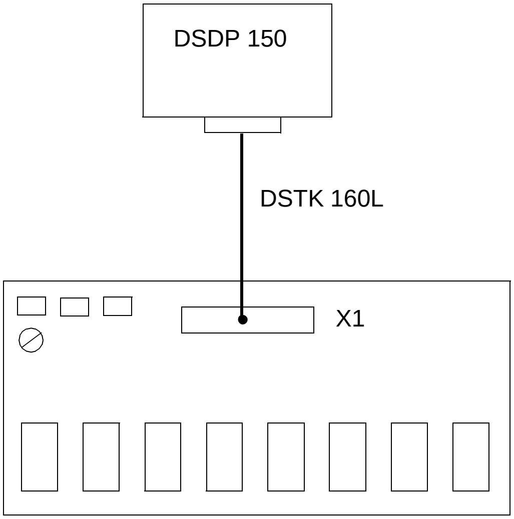

Figure 2-7. Connection of DSDP 150 to Interface Adapter Card

Connect as follows:

Connector X1 to position 1 - 6. Positions 7 and 8 are **not** used.

DSDP 150 should be configured for 24 V input signal.

2.2.3.8 DSDX 180

The Interface Adapter Card has four connectors for cables to two DSDX 180 (redundance), see Figure 2-8.

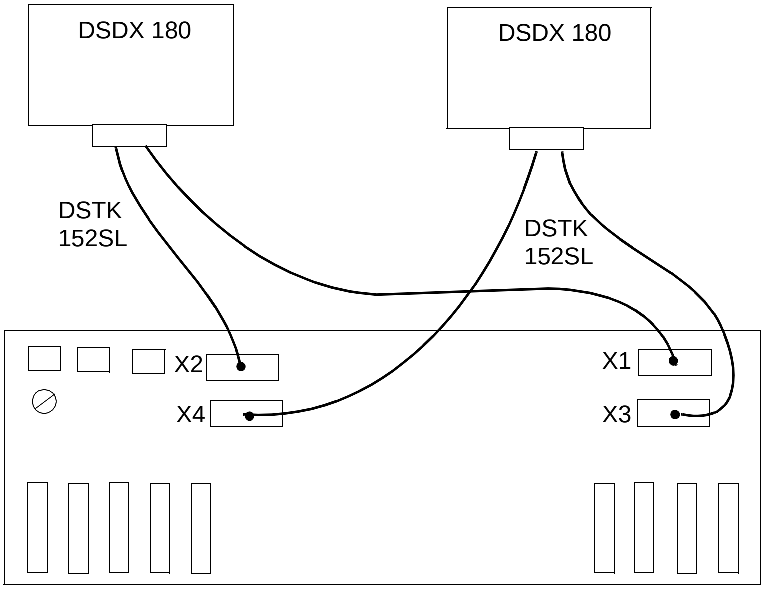

Figure 2-8. Connection of redundant DSDX 180 to Interface Adapter Card

Connect as follows.

Connectors X1 and X3 to position 1 - 8 and connectors X2 and X4 to position 9 - 16.

Only Bus Powered Intrinsic Safety Isolator output modules can be used.

2.2.4 Supported I/O Functions

S100 I/O board, cables, termination boards with integrated Interface Adapter Card and Intrinsic Safety Isolators.

Table 2-1. S100 I/O Boards

S100 I/O Board	**ABB Cable**	**S2000 Termination Board Interface Adapter Card**	**Note**	**Module Capability**	**Module Type (all two channel unless stated)**
DSAI 130	DSTK 160L	2108/HAT/ABB-AI-02	1 I/O cards	8	HiD2026, 2030, 2062, 2072
DSAI 133	DSTK 152SL	2116/HAT/ABB-AI-01 (1)	1 or 1+1 I/O cards	16	HiD2026, 2030, 2062, 2072
DSAO 120	DSTK 153SL	2108/HAT/ABB-AI-02 (1)	2 I/O cards	8	HiD2032, 2034, 2038
DSAX 110	DSTK 153SL	2108/HAT/ABB-AIO-01 (1)	1 or 1+1 I/O cards	8	HiD2026, 2030, 2062, 2072 HiD2032, 2034, 2038
DSDI 110 DSDI 115 DSDP 110	DSTK 160L	2108/HAT/ABB-DI-01	1 I/O card	8	HiD2824, 2844, (4ch)
DSDO 110 DSDO 115	DSTK 160L	2116/HAT/ABB-DO-01	1 I/O card	16	HiD2872, 2874
DSDX 180 (2)	DSTK 152SL	2116/HAT/ABB-DX-01	1 or 1+1 I/O cards, 2ch mods	16	HiD2822, 2842, 2872, 2874
DSDP 150	DSTK 160L	2108/HAT/ABB-DP-01	1 card, 6 pos. used	8	HiD2842

(1) Can be connected to HART mux HiD2700 via HART mux board 2108/64-HART-F.
(2) Only supported in MOD software.

Chapter 3 Configuration

3.1 Considerations

3.1.1 Termination Board

The termination board must be configured with a Interface Adapter Card adapted for the I/O board, which should be connected, see Table 3-1 and Table 3-2.

3.1.2 Intrinsic Safety Isolator Module

The function and signal range can be changed with jumpers on most of the I.S. Isolator modules, see *ELCON Instruments documentation* for the I.S. Isolator modules.
All analog input I.S. Isolator modules must be configured for 1-5 V output.

3.1.3 AI, AO and AX Boards

All AI channels that are connected towards the Intrinsic Safety System must be configured for 1-5 V.

All AO channels that are connected towards the Intrinsic Safety System must be configured for current output 4-20 mA.

Table 3-1. S100 AI, AO and AX Boards

S100 I/O Board	ABB Cable	S2000 Termination Board Interface Adapter Card	Note	Module Capability	Module Type (all two channel unless stated)
DSAI 130	DSTK 160L	2108/HAT/ABB-AI-02	1 I/O card	8	HiD2026, 2030, 2062, 2072
DSAI 133	DSTK 152SL	2116/HAT/ABB-AI-01	1 or 1+1 I/O cards	16	HiD2026, 2030, 2062, 2072
DSAO 120	DSTK 153SL	2108/HAT/ABB-AI-02	2 I/O cards	8	HiD2032, 2034 (1), 2038
DSAX 110	DSTK 153SL	2108/HAT/ABB-AIO-01	1 or 1+1 I/O cards	8	HiD2026, 2030, 2062, 2072 HiD2032, 2034, 2038

(1) HiD2034 can **only** be used for load resistance ≤ 150 ohm.

3.1.4 DI, DO, DP and DX Boards

No specific configuration is necessary except for DSDP 150.

Table 3-2. S100 DI, DO, DP and DX Boards

S100 I/O Board	**ABB Cable**	**S2000 Termination Board Interface Adapter Card**	**Note**	**Module Capability**	**Module Type (all two channel unless stated)**
DSDI 110 DSDI 115 DSDP 110	DSTK 160L	2108/HAT/ABB-DI-01	1 I/O card	8	HiD2824, 2844, (4ch)
DSDO 110 DSDO 115	DSTK 160L	2116/HAT/ABB-DO-01	1 I/O card	16	HiD2872, 2874
DSDP 150	DSTK 160L	2108/HAT/ABB-DP-01	1 card, 6 pos used	8	HiD2842 + tbd
DSDX 180	DSTK 152SL	2116/HAT/ABB-DX-01	1 or 1 + 1 card, 2 ch modules	16	HiD2822, 2842 HiD2872, 2874

HiD2872 can be configured for Loop power or Bus power.

Loop power: The output power is taken from the I/O board output channels.

Bus power: The output power is taken from the 24 V power supply bus.

For DSDP 150 must the input channels connected to I.S. Isolator modules been jumped for input signal level 24 V, see *S100 I/O Hardware Reference Manual, Chapter 4*.

3.2 Capacity and Performance

3.2.1 Technical Data

This document only deals with technical data influenced by the fact that the Advant Controller S100 I/O works together with ELCON Instruments Intrinsic Safety System series 2000.

Technical data for S100 I/O and the Intrinsic Safety System series 2000, see documentation for each system according to the document list in Section 1.5, Related Documentation.

3.2.2 Analog Input/Output

The maximum inaccuracy and the delay time for a analog input and output can be calculated as the sum of the inaccuracy and delay time of the system parts, Advant Controller 400 Series and Intrinsic Safety System series 2000.

3.2.3 Digital Input/Output

The maximum delay time for a digital input can be calculated as the sum of the delay time of the system parts, Advant Controller 400 Series and Intrinsic Safety System series 2000.

With use of time stamp of digital input signals the time delay in the I.S. Isolator module will be add to the time.

3.2.4 Pulse Counting/Frequency Measurement

The maximum input frequency is settle by the units (S100 board and S2000 module) with the lowest maximum input frequency range.

3.3 Application Procedures

No specific application programming must be done, except for the thermocouple and RTD signals. For the thermocouple signals the linearization and scaling of value in Fahrenheit or Celsius must be done in the application program. For RTD signals only scaling of value in Fahrenheit or Celsius is required in the application program.

3.3.1 Linearization TC Signal

Linearization of TC signal to get a temperature proportional signal can be done according to the following.

For example for TC type K -100 °C to 500 °C:

Table 3-3. Linearization of TC signal - Type K from -100 ºC to *500* ºC

Temperature [(1)]	**TC Voltage** [(1)]	**I.S. Module Output Voltage**
-100 °C	-3553	1 V
500 °C	20640	5 V

(1) Those values can be taken from standard table IEC 584-1 or similar.

Pick some additional values between -100 °C and 500 °C and calculate the value out from the I.S. module according to following formula.

$$a + \frac{b - a}{d - c} \bullet e = f$$

a = I.S. output value min. (1 V)

b = I.S. output value max. (5 V)

c = TC voltage at min. temperature

d = TC voltage at max. temperature

e = TC voltage at temperature X

f = I.S. output value at temperature X

Put in the values in a linearization function with I.S. module output voltage as value on the X-axis and the temperature value on the Y-axis.

3.3.1.1 Linearization in Advant Controller with Master Software

Application program for linearization and scaling see Figure 3-1.

The value to be entered on RANGEMIN and RANGEMAX terminal of the data base element for analog input channel.

For example with a signal range of -100 to 500 °C and a thermocouple of type K:

- For RANGEMIN value the corresponding value to -100 °C is -3553.
- For RANGEMAX value the corresponding value to 500 °C is 20640.

The values are the same as the output value out from the thermocouple at the minimum and maximum values of the present signal range with the reference temperature at 0 °C.

The values to be entered on inputs I1 to I30 on PC element REG-G item designations .1 and .2 is found in standard tables. The values for REG-G .1 are the temperature values in °C for the given temperature points. The values for REG-G .2 are the values in µV as output from the thermocouple at given temperature points with a reference temperature of 0 °C.

The PC elements .4 and .5 are used for conversion of the signal from °C to °F and can leave out if the output value shall be in °C.

Conversion to°F can also be done directly if the values to REG-G .1 are given in °F instead of in °C.

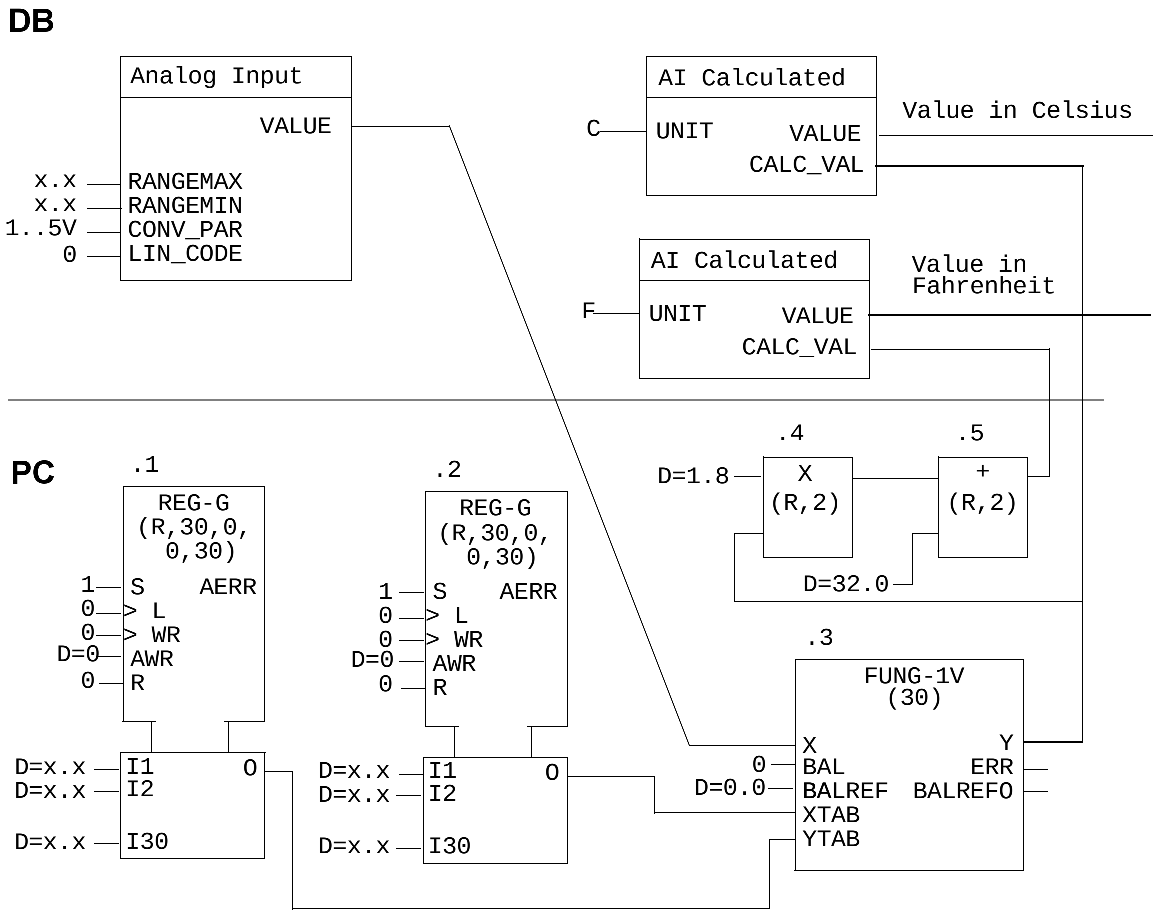

Figure 3-1. Application Program for Linearization and Scaling of TC Signal

3.3.2 Scaling of RTD and TC Signals

Scaling between degrees Celsius or degrees Fahrenheit can be done according to formula.

`Degrees F = (Degrees C • 9/5) + 32`

In Advant Controller 400 with Master Software an application to convert degrees C to degrees F can be built up according to Figure 3-1, element .4 and .5.

Chapter 4 Operation

Not applicable

Chapter 5 Maintenance

5.1 Hardware Indicators

S100 I/O boards, termination boards and the I.S. Isolator modules have LED indicators showing different type of status, see documentation for each board and module.

5.2 Fault Finding and User Repair

The fault finding description in this document is intendant be a help to find out in which of the parts, process, Intrinsic Safety System, S100 I/O boards or controller a fault is located.

5.2.1 Interface Adapter Card

Check the LED indicators on the Interface Adapter Card according to Table 5-1.

Table 5-1. Control of LED Indicators

LED Indicators		**Description**
Fault	**Power on**	
X	Off	Check the power supply (24 V) and the fuse F1 (on the termination board).
Off	On	Normal
On	On	Some modules have a fault. Check the fault LED on the I.S. module.

5.2.2 Analog Input Signals, Current, RTD and TC

Check the LED indicators on the I.S. Isolator module and the analog input board according to the table.

Table 5-2. Control of LED Indicators

I.S. Isolator Module		**Analog Input Board**		**Action**
Fault (1)	**Power on**	**F**	**C**	
X	Off	X	X	The fault is located in the Intrinsic Safety System, check power supply.
X	On	On	X	The fault is located on the AI board or in the Controller
X	On	Off	Off	The fault is located on the AI board or in the Controller
Off	On	Off	On (2)	Check the signal level on the input and the output of the I.S. Isolator module
On	On	X	X	The fault is located in the field

(1) **Only** HiD2030
(2) Can also flash.

Check the Signal Level on the Input of the I.S. Isolator Module

Circuit diagram for analog input channel, see Figure 5-1, to Figure 5-3.

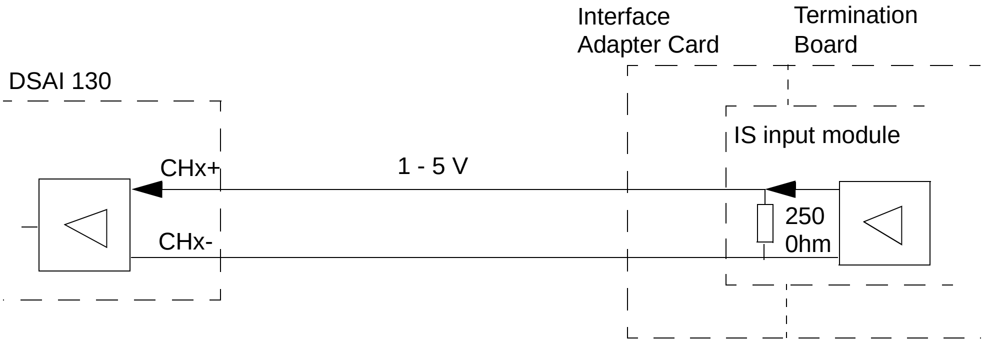

Figure 5-1. Circuit diagram for DSAI 130

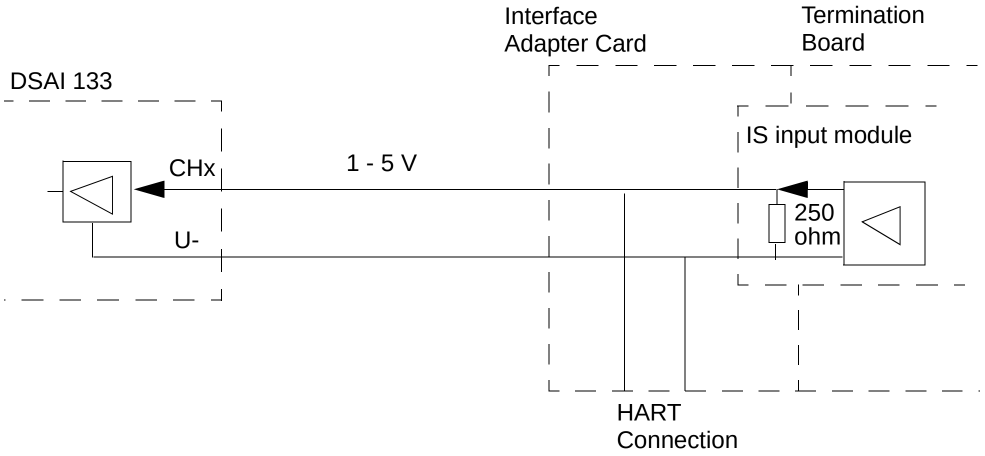

Figure 5-2. Circuit Diagram for DSAI 133

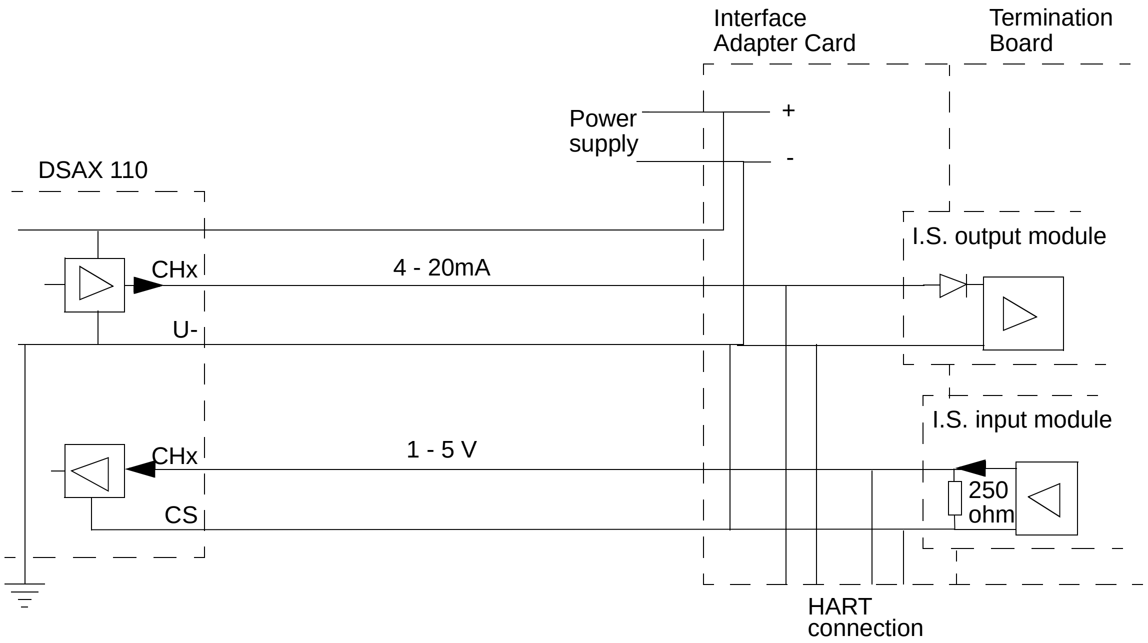

Figure 5-3. Circuit Diagram for DSAX 110

The best point to measure the output signal from the I.S. Isolator module is in the connectors on the adapter board. To find the right pins, see Table 5-3 to Table 5-6. Connect the voltmeter between the channel and U-, the voltmeter should have high input impedance.

Output from the I.S. Isolator module is 1 to 5 V for 0 to 100% signal.

Measuring of input signal for I.S. Isolator modules HiD2026 or HiD2030:

Measure the input current (4-20 mA)

- If the input signal is not correct, measure the voltage over the input (should be > 15 V)
- If the input signal is under 15 V, brake up the process connection
    - If it is still low the fault is located in the Intrinsic Safety System (I.S. Isolator module)
    - If it goes high the fault is located in the process

Measuring of input signal for I.S. Isolator modules HiD2062:

- Input voltage is dependent of thermocouple type and the sensor temperature (from -9 mV up to 80 mV), see *Elcon Instruments documentation*.

Measuring of input signal for I.S. Isolator modules HiD2072:

- Measure the input voltage (input voltage = 0.4 mA $*$ sensor resistance).

Table 5-3. Interface Adapter Card Connector pinning for DSAI 130

Ex i Module		**X1**	
Pos	**Mod Ch**	**Pin**	**Sign**
1	1	A19	ICh1+
		B19	ICh1-
	2	A18	ICh2+
		B18	ICh2-
2	1	A17	ICh3+
		B17	ICh3-
	2	A16	ICh4+
		B16	ICh4-
3	1	A15	ICh5+
		B15	ICh5-
	2	A13	ICh6+
		B13	ICh6-
4	1	A12	ICh7+
		B12	ICh7-
	2	A11	ICh8+
		B11	ICh8-
5	1	A10	ICh9+
		B10	ICh9-
	2	A9	ICh10+
		B9	ICh10-
6	1	A8	ICh11+
		B8	ICh11-

Table 5-3. Interface Adapter Card Connector pinning for DSAI 130 (Continued)

Ex i Module		**X1**	
Pos	**Mod Ch**	**Pin**	**Sign**
	2	A6	ICh12+
		B6	ICh12-
7	1	A5	ICh13+
		B5	ICh13-
	2	A4	ICh14+
		B4	ICh14-
8	1	A3	ICh15+
		B3	ICh15-
	2	A2	ICh16+
		B2	ICh16-
		B1	0 V
		B20	0 V
		B7	0 V
		B14	0 V

Table 5-4. Interface Adapter Card Connectors (X1 - X4) pinning for DSAI 133

Ex i Mod		**Con. X1 & X2**		**Ex i Mod**		**Con. X3 & X4**	
Pos	**Ch**	**Pin**	**Sign.**	**Pos**	**Ch**	**Pin**	**Sign.**
		B13	U+			B13	U+
1	1	A13	CH1	9	1	A13	CH17
	2	B12	CH2		2	B12	CH18
2	1	A12	CH3	10	1	A12	CH19
	2	B11	CH4		2	B11	CH20
3	1	A11	CH5	11	1	A11	CH21
	2	B10	CH6		2	B10	CH22
4	1	A10	CH7	12	1	A10	CH23
	2	B9	CH8		2	B9	CH24
		A9	U-			A9	U-
		B8	U-			B8	U-
		A8	U+			A8	U+
5	1	B7	CH9	13	1	B7	CH25
	2	A7	CH10		2	A7	CH26
6	1	B6	CH11	14	1	B6	CH27
	2	A6	CH12		2	A6	CH28
7	1	B5	CH13	15	1	B5	CH29
	2	A5	CH14		2	A5	CH30
8	1	B4	CH15	16	1	B4	CH31
	2	A4	CH16		2	A4	CH32
		B3	U-			B3	U-

Table 5-4. Interface Adapter Card Connectors (X1 - X4) pinning for DSAI 133 (Continued)

Ex i Mod		Con. X1 & X2		Ex i Mod		Con. X3 & X4	
Pos	**Ch**	**Pin**	**Sign.**	**Pos**	**Ch**	**Pin**	**Sign.**
		A3	U-			A3	U-
		B2	U-			B2	U-
		A2	U-			A2	U-
		B1	U-			B1	U-
		A1	U-			A1	U-

Table 5-5. Interface Adapter Card Hart Connectors (1 and 2) pinning for DSAI 133

Ex i Mod		HART Con. 1		Ex i Mod		HART Con. 2	
Pos	**Ch**	**Pin**	**Sign.**	**Pos**	**Ch**	**Pin**	**Sign.**
1	1	1	CH1+	9	1	1	CH17+
	1	2	U-		1	2	U-
	2	3	CH2+		2	3	CH18+
	2	4	U-		2	4	U-
2	1	5	CH3+	10	1	5	CH19+
	1	6	U-		1	6	U-
	2	7	CH4+		2	7	CH20+
	2	8	U-		2	8	U-
3	1	9	CH5+	11	1	9	CH21+
	1	10	U-		1	10	U-

Table 5-5. Interface Adapter Card Hart Connectors (1 and 2) pinning for DSAI 133 (Continued)

Ex i Mod		HART Con. 1		Ex i Mod		HART Con. 2	
Pos	**Ch**	**Pin**	**Sign.**	**Pos**	**Ch**	**Pin**	**Sign.**
	2	11	CH6+		2	11	CH22+
	2	12	U-		2	12	U-
4	1	13	CH7+	12	1	13	CH23+
	1	14	U-		1	14	U-
	2	15	CH8+		2	15	CH24+
	2	16	U-		2	16	U-
5	1	17	CH9+	13	1	17	CH25+
	1	18	U-		1	18	U-
	2	19	CH10+		2	19	CH26+
	2	20	U-		2	20	U-
6	1	21	CH11+	14	1	21	CH27+
	1	22	U-		1	22	U-
	2	23	CH12+		2	23	CH28+
	2	24	U-		2	24	U-
7	1	25	CH13+	15	1	25	CH29+
	1	26	U-		1	26	U-
	2	27	CH14+		2	27	CH30+
	2	28	U-		2	28	U-
8	1	29	CH15+	16	1	29	CH31+
	1	30	U-		1	30	U-
	2	31	CH16+		2	31	CH32+
	2	32	U-		2	32	U-

Table 5-6. Interface Adapter Card Connector pinning for DSAX 110

Ex i Mod		Connector X1		Connector X2		HART Connector	
Pos	**Mod Ch**	**Pin**	**Sign.**	**Pin**	**Sign.**	**Pin**	**Sign.**
1	1	A13	ICH1	A13	ICH1	1	CH1/17
						2	U-
	2	B12	ICH2	B12	ICH2	3	CH2/18
						4	U-
2	1	A12	ICH3	A12	ICH3	5	CH3/19
						6	U-
	2	B11	ICH4	B11	ICH4	7	CH4/20
						8	U-
3	1	A11	ICH5	A11	ICH5	9	CH5/21
						10	U-
	2	B10	ICH6	B10	ICH6	11	CH6/22
						12	U-
4	1	A10	ICH7	A10	ICH7	13	CH7/23
						14	U-
	2	B9	ICH8	B9	ICH8	15	CH8/24
						16	U-
5	1	B7	OCH1	B7	OCH1	17	CH9/25
						18	U-
	2	A7	OCH2	A7	OCH2	19	CH10/26
						20	U-
6	1	B6	OCH3	B6	OCH3	21	CH11/27
						22	U-

Table 5-6. Interface Adapter Card Connector pinning for DSAX 110 (Continued)

Ex i Mod		Connector X1		Connector X2		HART Connector	
Pos	**Mod Ch**	**Pin**	**Sign.**	**Pin**	**Sign.**	**Pin**	**Sign.**
	2	A6	OCH4	A6	OCH4	23	CH12/28
						24	U-
7	1	B5	OCH5	B5	OCH5	25	CH13/29
						26	U-
	2	A5	OCH6	A5	OCH6	27	CH14/30
						28	U-
8	1	B4	OCH7	B4	OCH7	29	CH15/31
						30	U-
	2	A4	OCH8	A4	OCH8	31	CH16/32
						32	U-
		A9	U-	A9	U-		
		B8	U-	B8	U-		
		B3	U-	B3	U-		
		A3	U-	A3	U-		
		B13	U+	B13	U+		
		A8	U+	A8	U+		
		B2 (1)		B1(1)			
		A2 (1)		A1 (1)			
		B1 (1)		B2 (1)			
		A1(1)		A2 (1)			

(1) XI:B2 connected to X2:B1
X1:A2 connected to X2:A1
X1:B1 connected to X2:B2
X1:A1 connected to X2:A2

5.2.3 Analog Output Signals

Check the LED indicators on the I.S. Isolator module and the analog output board according to Table 5-7.

I.S. Isolator module type 2034 need no power supply and have therefore no power on indication

.

Table 5-7. Control of LED Indicators

I.S. Isolator Module		**Analog Output Board**	**Action**
Fault [1]	**Power On**	**F**	
X	Off	X	The fault is located in the Intrinsic Safety System. Check the power supply.
Off	On	On	The fault is located on the AO board or in the Controller.
Off	On	Off	Check the signal level on the input and the output of the I.S. Isolator module.
On	On	X	The fault is located in the field.

(1) **Only** HiD2038.

Check the Signal Level on the Output of the I.S. Isolator Module

Circuit diagram for analog output channel, see Figure 5-4 and Figure 5-5.

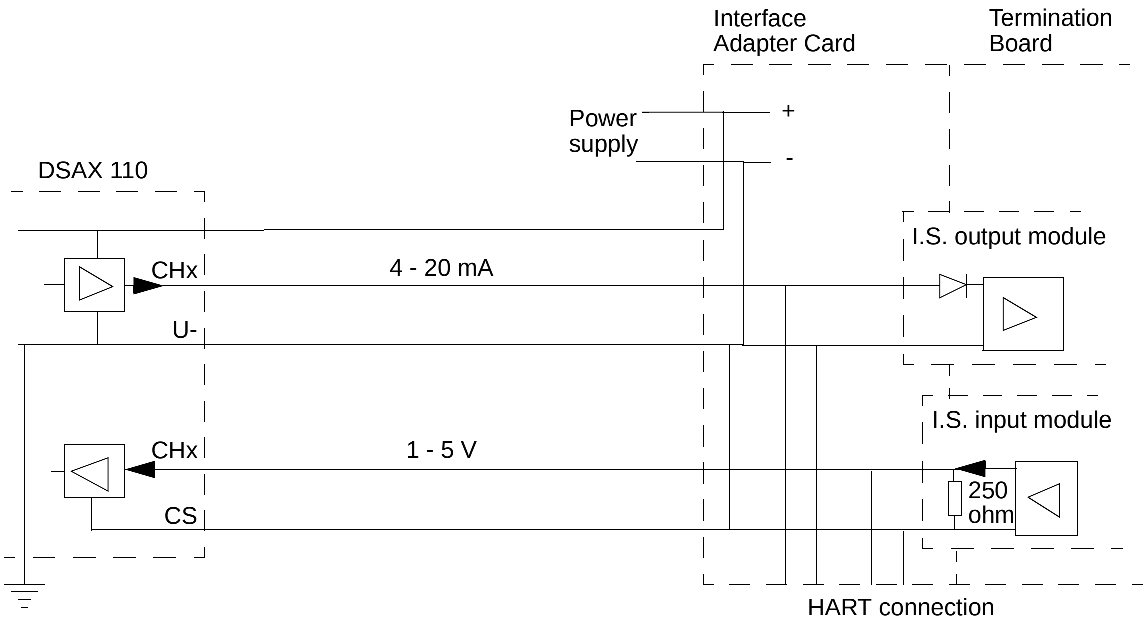

Figure 5-4. Circuit Diagram for DSAX 110

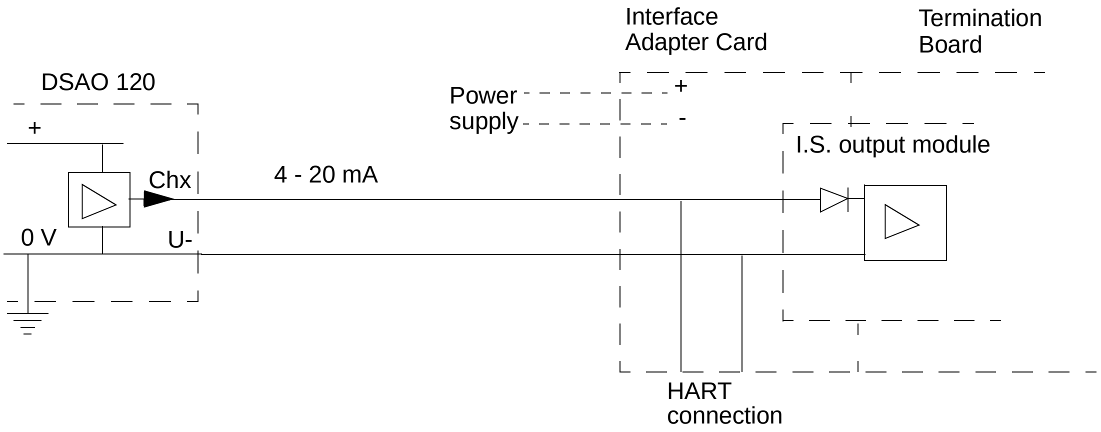

Figure 5-5. Circuit Diagram for DSAIO 120

The best point to measure the input signal to the I.S. Isolator module is in the connectors on the Interface Adapter Card. To find the right pins, see Table 5-8 and Table 5-10. Measuring of input current signal to the I.S. Isolator module:

Connect the ampere meter between the channel and U-, the ampere meter should have low input impedance. The measured current should be about the same as the I/O board put out.

Connect the voltmeter between the channel and U-, the voltmeter should have high input impedance.

The measured input dropout voltage should be for I.S. Isolator module type.

2038 and 2032:	< 4 V with field wiring intact
	> 4 V with field wiring open or faulty I.S. module
2034:	Voltage dropout + output current × load residence
	Voltage dropout at 20 mA of 7 V (at 500Ω load)
	DSAO 120 can give max. 10 V.

Measuring of output current signal from the I.S. Isolator module:

- Disconnect one of the process cables and connect an ampere meter between the cable and the connector (4-20 mA).
- If the load impedance and the line resistance are known is it easier to measure the voltage over the output but the accuracy will not be so high.

  Output voltage = output current × (load impedance + line resistance).

Table 5-8. Interface Adapter Card Connector pinning for DSAO120

Ex i Module		**Connector X1**		**Connector X2**		**HART Connector**	
Pos	**Ch**	**Pin**	**Sign**	**Pin**	**Sign**	**Pin**	**Sign**
1	1	B13	Ch1+			1	Ch1+
	1	A11	U-			2	U-
	2	B12	Ch2+			3	Ch2+
	2	B11	U-			4	U-
2	1	B10	Ch3+			5	Ch3+
	1	A8	U-			6	U-
	2	B9	Ch4+			7	Ch4+
	2	B8	U-			8	U-
3	1	B7	Ch5+			9	Ch5+
	1	A5	U-			10	U-
	2	B6	Ch6+			11	Ch6+
	2	B5	U-			12	U-
4	1	B4	Ch7+			13	Ch7+
	1	A2	U-			14	U-
	2	B3	Ch8+			15	Ch8+
	2	B2	U-			16	U-

Table 5-8. Interface Adapter Card Connector pinning for DSAO120 (Continued)

Ex i Module		Connector X1		Connector X2		HART Connector	
Pos	**Ch**	**Pin**	**Sign**	**Pin**	**Sign**	**Pin**	**Sign**
5	1			B13	Ch1+	17	Ch9+
	1			A11	U-	18	U-
	2			B12	Ch2+	19	Ch10+
	2			B11	U-	20	U-
6	1			B10	Ch3+	21	Ch11+
	1			A8	U-	22	U-
	2			B9	Ch4+	23	Ch12+
	2			B8	U-	24	U-
7	1			B7	Ch5+	25	Ch13+
	1			A5	U-	26	U-
	2			B6	Ch6+	27	Ch14+
	2			B5	U-	28	U-
8	1			B4	Ch7+	29	Ch15+
	1			A2	U-	30	U-
	2			B3	Ch8+	31	Ch16+
	2			B2	U-	32	U-

5.2.4 Digital Input Signals and Pulse Counting Signals

Check the LED indicators on the termination board, the I.S. Isolator module and the digital input board according to Table 5-9.

Table 5-9. Control of LED Indicators

I.S. Isolator Module			**Digital Input Board**		**Action**
Power on	**Fault**	**Ch**	**F**	**Ch**	
Off	X	X	X	X	The fault is located in the Intrinsic Safety System. Check power supply.
On	X	X	On	X	The fault is located on the DI board or in the Controller
On	On	X	X	X	The fault is located in the process (short circuit or open circuit)
On	Off	Off	Off	On	Check the signal level on the output of the I.S. Isolator module (1) if > 15 V: the fault is located in the Intrinsic Safety System if < 5 V: the fault is located on the DI board or in the Controller
On	Off	On	Off	Off	Check the signal level on the output of the I.S. Isolator module (1) if < 5 V: the fault is located in the Intrinsic Safety System if > 15 V: the fault is located on the DI board or in the Controller
On	Off	Off	Off	Off	Check the signal level on the input of the I.S. Isolator module (2)
On	Off	On	Off	On	Check the signal level on the input of the I.S. Isolator module (2)

(1) The best point to measure the output signal from the I.S. Isolator module is to use the connectors on the Interface Adapter Card.
To find the right pins see Table 5-10 and 5-11. Connect a voltmeter between the channel and U-.

(2) The input signals type is dependent of the I.S. Isolator module type and the configuration.
Check of I.S. Isolator module see Instruction Manual for the I.S. Isolator module.

Circuit diagram for digital input and pulse input channel, see Figure 5-6, Figure 5-7, and Figure 5-8.

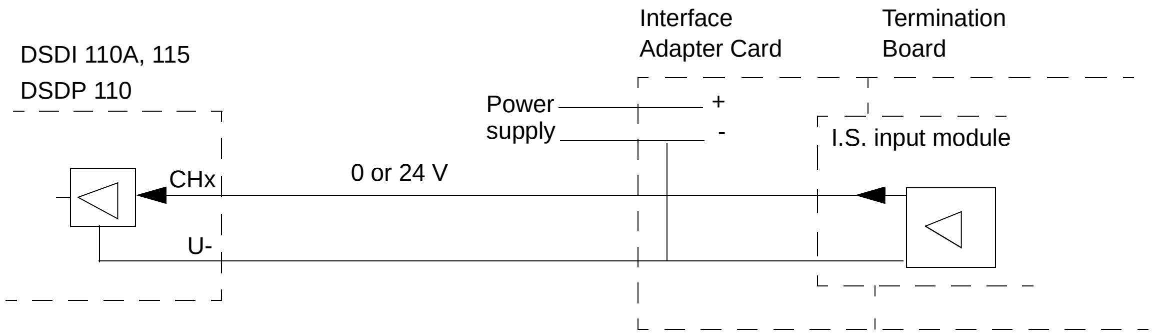

Figure 5-6. Circuit Diagram for DSDI 110A, DSDI 115, and DSDP 110

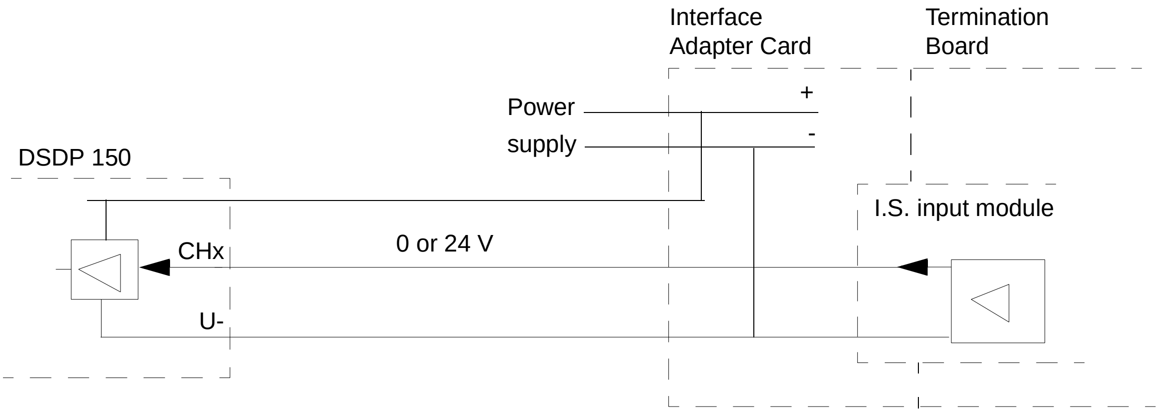

Figure 5-7. Circuit Diagram for DSDP 150

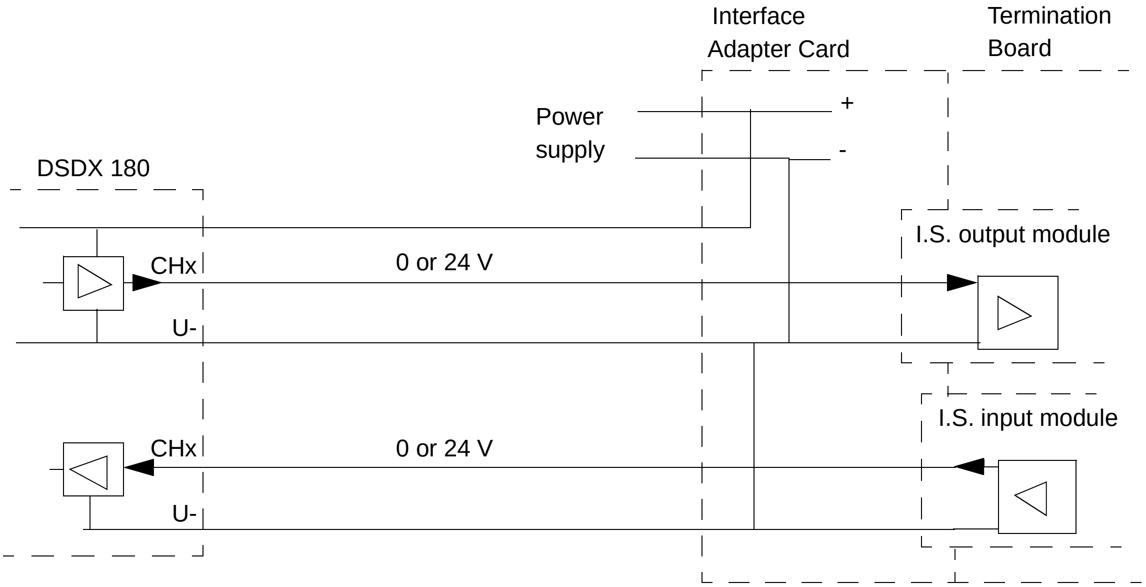

Figure 5-8. Circuit Diagram for DSDX 180

Table 5-10. Interface Adapter Card Connector pinning for DSDI 110A/115, DSDP 110

Ex i Module		**X1**	
Pos	**Ch**	**Pin**	**Sign**
		B20	U1+
1	1	A20	CH1
	2	B19	CH2
	3	A19	CH3
	4	B18	CH4
2	1	A18	CH5
	2	B17	CH6
	3	A17	CH7
	4	B16	CH8
		A16	U1-
		B15	U2+
3	1	A15	CH9
	2	B14	CH10
	3	A14	11
	4	B13	12
4	1	A13	13
	2	B12	14
	3	A12	15
	4	B11	16
		A11	U2-
		B10	U3+

Table 5-10. Interface Adapter Card Connector pinning for DSDI 110A/115, DSDP 110 (Continued)

Ex i Module		**X1**	
Pos	**Ch**	**Pin**	**Sign**
5	1	A10	17
	2	B9	18
	3	A9	19
	4	B8	20
6	1	A8	21
	2	B7	22
	3	A7	23
	4	B6	24
		A6	U3-
		B5	U4+
7	1	A5	25
	2	B4	26
	3	A4	27
	4	B3	28
8	1	A3	29
	2	B2	30
	3	A2	31
	4	B1	32
		A1	U-

Table 5-11. Interface Adapter Card Connector pinning for DSDP 150

Ex i Module		**X1**	
Pos	**Ch**	**Pin**	**Sign**
		B5	U+
1	1	A10	ICh1
	2	B9	ICh2
2	1	A9	ICh3
	2	B8	ICh4
3	1	A8	ICh5
	2	B7	ICh6
4	1	A5	ICh7
	2	B4	ICh8
		A1	U-
		B10	U+
5	1	A4	ICh9
	2	B3	ICh10
6	1	A3	ICh11
	2	B2	ICh12
7	1		
	2		
8	1		
	2		
		A6	U-

5.2.5 Digital Output Signals

Check the LED indicators on the termination board, the I.S. Isolator module and the digital output board according to Table 5-12.

Table 5-12. Control of LED Indicators

I.S. Isolator Module			**Digital Output Board**		**Action**
Fault (1)	**Power on**	**Ch**	**F**	**Ch**	
X	Off	X	X	X	The fault is located in the Intrinsic Safety System. Check power supply.
X	On	X	On	X	The fault is located on the DO board or in the controller
Off	On	Off	Off	On	Check the signal level on the input of the I.S. Isolator module (2) If > 17 V: the fault is located in the Intrinsic Safety System If < 17 V: the fault is located on the DO board or in the controller
Off	On	On	Off	Off	Check the signal level on the input of the I.S. Isolator module (2) If < 5 V: the fault is located in the Intrinsic Safety System If > 5 V: the fault is located on the DO board or in the controller
Off	On	Off	Off	Off	Check the signal level on the output of the I.S. Isolator module (3) If on: fault in the Intrinsic Safety System If off: try to change to on and do check according to next row
Off	On	On	Off	On	Check the signal level on the output of the I.S. Isolator module (3)) If off: short circuit or fault in the Intrinsic Safety System If on: try to change to off and do check according to previous row
On	On	X	X	X	Open or shorted output line

(1) **Only** 2874.
(2) The best point to measure the input signal to the I.S. Isolator module is to use the connectors on the Interface Adapter Card. To find the right pins see Table 5-13. Connect a voltmeter between the channel and U-.
(3) The output signals type is dependent of the I.S. Isolator module type.
Check of I.S. Isolator module see Instruction Manual for the I.S. Isolator module.

Circuit diagram for digital output channel, see Figure 5-9 and Figure 5-10.

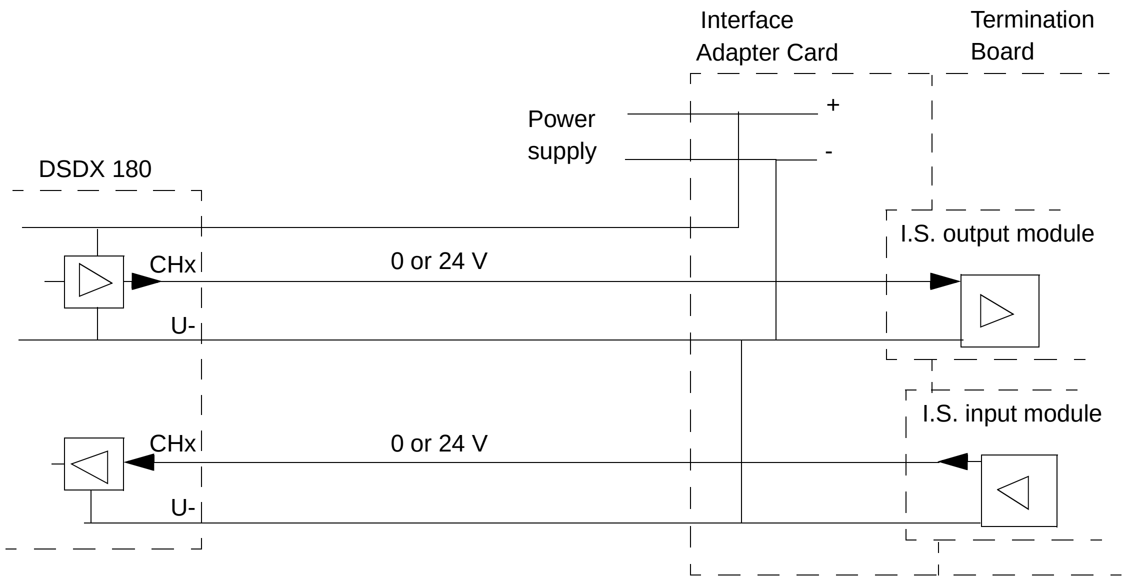

Figure 5-9. Circuit Diagram for DSDX 180

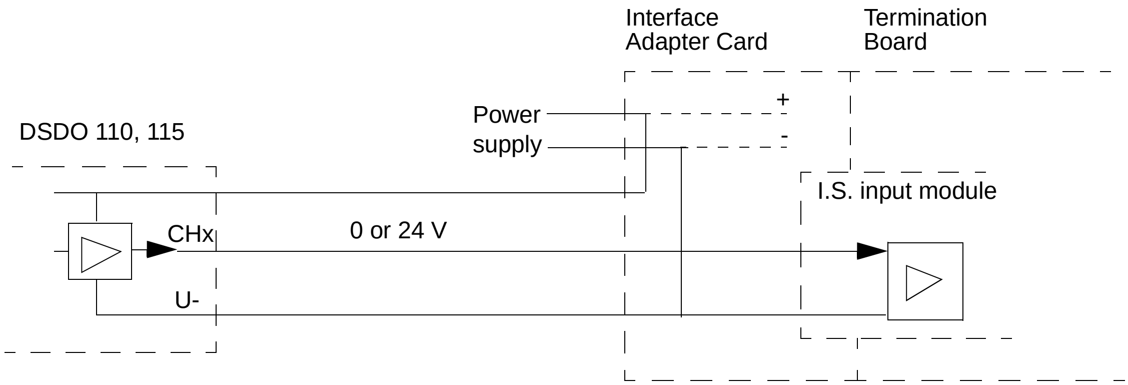

Figure 5-10. Circuit Diagram for DSDO 110 and DSDO 115

Table 5-13. Interface Adapter Card Connector pinning for DSDO 110/115

Ex i Module		**X1**	
Pos	**Ch**	**Pin**	**Sign**
		B20	U1+
1	1	A20	CH1
	2	B19	CH2
2	1	A19	CH3
	2	B18	CH4
3	1	A18	CH5
	2	B17	CH6
4	1	A17	CH7
	2	B16	CH8
		A16	U1-
		B15	U2+
5	1	A15	CH9
	2	B14	CH10
6	1	A14	CH11
	2	B13	CH12
7	1	A13	CH13
	2	B12	CH14
8	1	A12	CH15
	2	B11	CH16
		A11	U2-
		B10	U3+

Table 5-13. Interface Adapter Card Connector pinning for DSDO 110/115 (Continued)

Ex i Module		**X1**	
Pos	**Ch**	**Pin**	**Sign**
9	1	A10	CH17
	2	B9	CH18
10	1	A9	CH19
	2	B8	CH20
11	1	A8	CH21
	2	B7	CH22
12	1	A7	CH23
	2	B6	CH24
		A6	U3-
		B5	U4+
13	1	A5	CH25
	2	B4	CH26
14	1	A4	CH27
	2	B3	CH28
15	1	A3	CH29
	2	B2	CH30
16	1	A2	CH31
	2	B1	CH32
		A1	U-

INDEX

A

Application programming
    RTD signals 34
    Thermocouple signals 34

C

Cabinets 12
Cable 19
Cable connection
    DSAI 130 21
    DSAI 133 22
    DSAO 120 23
    DSAX 110 (redundance) 24
    DSDI 110A 25
    DSDI 115 25
    DSDO 110 26
    DSDO 115 26
    DSDP 110 25
    DSDP 150 27
    DSDX 180 28
    HART 23 to 24
Configuration
    AI channels 31
    AO channels 31
    DI channels 33
    DO channels 33
    DSDP 150 channels 33
    DX channels 33

D

DSAI 130 7
DSAI 133 7
DSAO 120 7
DSAX 110 7
DSDI 110A 7
DSDI 115 7
DSDO 110 7
DSDO 115 7
DSDP 110 7
DSDP 150 7
DSDX 180 7

H

HART 5

I

Interface adapter card 8
Intrinsic safety isolator module 10

L

LED indicators
    Analog input board 42
    Analog output board 53
    Digital input board 58
    Digital output board 64
    I.S. isolator mdule 42, 53, 58, 64
    Interface adapter card 41
    Termination board 58, 64

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